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ABSTRACT

Fast and comfortable access to literature in teaching mathematics at all levels is discussed. For this purpose the most important bibliographic database for theory and practice in mathematics education, the database MATHDI, is presented in more detail. The literature search in MATHDI is exemplified by identifying literature relating to the topic of this conference. (Author)

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ELECTRONIC ACCESS TO LITERATURE IN MATHEMATICS EDUCATION

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ABSTRACT

Fast and comfortable access to literature in teaching mathematics at all levels is discussed. For this purpose the most important bibliographic database for theory and practice in mathematics education, the database MATHDI, is presented in more detail. The literature search in MATHDI is exemplified by identifying literature relating to the topic of this conference.

Mathematics Education Subject Classification of ZDM (MESC): A50

Keywords: mathematics education, information retrieval, Databases, online searching, online systems, educational research, abstracts

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1. Introduction

There has been a substantial increase in publications dealing with research in mathematical education in general and in particular on experiments in various countries, new pedagogical concepts and insights, topics, and teaching concepts. One of the features of the growth is the increasing number of conference proceedings (this conference is an example of new conferences established during the last decade), collections of papers, reports, etc. being published. The penetration of calculators and computers in education led to the creation of whole new areas of research. Another aspect is the expansion of journals in this field in both number and page count. Journals are of great importance for everyone interested in national developments as well as in an international exchange of ideas. About 400 journals on mathematics education and/or computer science education serve worldwide as channels for scientific communication (see an overview in http://www.fiz-karlsruhe.de/fiz/publications/zdm/zdmzs.html).

This ever increasing flood of information is a problem encountered in most fields of science: for example, some 120,000 books and papers on physics and engineering are published every year and some 60,000 on mathematics and its applications. It is well known that the production of what we may call scientific literature will continue to increase exponentially unless there are drastic changes in the practice of scientific research. Educational professionals like other scientists are thus faced with the problem of how to extract those items which they need for their own work from a vast pool of potential information.

The purpose of this paper is to provide an insight into how to cope with this flood of information. The reader is given some information on the international services which may help him or her keep up to date with the current progress in elementary mathematics and mathematical education: abstracting journals and on-line databases.

2. On-line Literature Databases in Mathematics Education

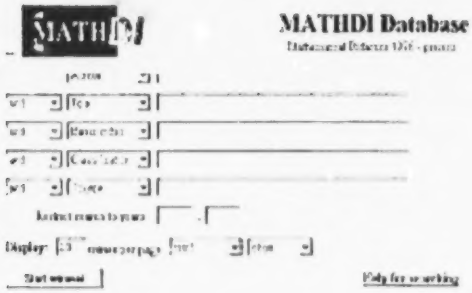
If one wants to read research studies in mathematics education or experience reports on proposed curriculum changes, how does one find them?

It is possible to look for published research in mathematics education by browsing through recent issues of internationally well-known journals such as *Journal of Research in Mathematics Education*, or *Educational Studies, or ZDM* (see paragraph 4), or by scanning national core journals. Browsing is haphazard at best and a time consuming method for searching for a particular subject. Searching so-called bibliographic databases – automated indices of published literature – is the most efficient and effective way to identify literature of relevance to a particular question or aspect.

2.1 Database MATHDI

The most important bibliographic database for research in mathematics education is MATHDI (MATHematical DIdactics) produced, designed and offered by FIZ Karlsruhe. On the Internet MATHDI is offered through the World Wide Web via the EMIS service of the European Mathematical Society (EMS). The rich array of useful literature information is available through http://www.emis.de. Another possibility of availability is through the host STN International.

MATHDI provides the quickest and most convenient access to literature in mathematics education and computer science education. It contains literature reviewed since 1976, totaling 95,000 references (31.12.2001). Some 6,000 items are added each year.



Subject coverage of MATHDI:

- Research in mathematics education,
- methodology of didactics of mathematics,
- mathematical instruction from elementary school to university teaching and teacher training,
- elementary mathematics and its applications,
- computer science education,
- basic pedagogical and psychological issues for mathematics and science education.

MATHDI is intended for:

- didacticians of mathematics in research and education,
- trainers and lecturers,
- educational technologists, instructional designers, and curriculum experts,
- policy-makers and educational administrators,
- teachers in general, special and vocational schools,
- librarians and information specialists.
-

2.2 Other Bibliographic Databases of Interest

Another important bibliographic database for research in mathematics education is ERIC. Sponsored by the U.S. Department of Education, the Education Resources Information Center database contains more than a million citations to education related documents and journal articles. It covers educational research at all levels in all subjects published as journal article or report or dissertation. The bias is on US-American publications.

Other databases of interest are PsycINFO and Zentralblatt MATH. PsycINFO is produced by the American Psychological Association and covers international literature in psychology and related behavioral and social sciences, including education. Zentralblatt MATH is also multilingual and international in scope. It contains references to the worldwide literature drawn from more than 2,300 journals and serials, from conference proceedings, reports, and books. Zentralblatt MATH input is about 65,000 items per year, produced by more than 7,000 scientists. Although the emphasis is on pure and applied mathematics literature on undergraduate mathematics is indexed as well.

Summarizing, if a mathematics educator needs an overview on relevant scholarly publications for writing an article, delivering a conference paper, or approaching a new working field, the search in MATHDI, complemented sometimes by the other databases mentioned, will help to be up to date. Especially with the computer on-line search the searcher has almost unlimited flexibil-

ity to tailor the results to precise specifications, to be as broad or as narrow as desired, to include or exclude certain factors, or to combine search terms.

3. CD-ROM MATHDI

MATHDI is also available on a CD-ROM. This alternative electronic medium of scholarly information offers the following attractive features:

- reviews and bibliographic data from MATHDI, from 1976 to 2000 (about 90,000 citations in mathematical education),
- time-independent searching,
- no additional costs e.g. telecommunication costs.

CD-ROM MATHDI allows to search with a command language (retrieval language used on the STN International host) or with an independent easy-to-use menu system.

MATHDI

Now, for the first time, one can have instant access, every hour of the day, to literature about mathematics education throughout the world. The CD-ROM MATHDI is the most appropriate medium of output when you need information on your desk, your working place or directly on your computer. It is also comfortable in libraries for students use.

4. Printed Abstracting Service in Maths Education: ZDM

MATHDI is the online computer file of bibliographic information compiled by ZDM. ZDM is the acronym for ***Zentralblatt für Didaktik der Mathematik*** / International Reviews on Mathematical Education. This well established information and abstract journal started in 1968 within the field of mathematical education and expanded its scope ten years ago to computer science education. The journal is published every two months, each issue containing an *articles section* with articles of particular interest to educational professionals and a *documentation section*.

4.1 Documentation Section of ZDM

The main part of ZDM is dedicated to documentation. The documentation section is an abstract service and reference tool providing ready access to worldwide publications on topics such as mathematics teaching, basic pedagogical and psychological problems, elementary mathematics and its applications as well as computer science education and recreational computing. The infor-

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mation presented is extracted from all relevant documents. The publications are announced in the documentation section by bibliographic data and abstracts mostly in English.

The bibliographic part of ZDM is followed by an *index section*, facilitating pinpointed retrieval of documents according to different criteria: author, subject, corporate and source/affiliation, journal title.

In 1976 its online database MATHDI was introduced. As described in paragraph 2 it provides bibliographic information on entries in ZDM from 1976 to the present.

4.1.1 Mathematics Education Subject Classification (MESC)

To arrange entries in the printed service, a classification scheme for mathematics education was developed in the late sixties. The number and terminology of subject headings have changed over the years. The last revision has been in 1999. All subject categories are represented by a three digit notation, consisting of headings (determined by a capital letter) each with 10 subheadings. In the third position the special field of education is indicated such as primary education, secondary education, vocational education, or teacher education.

Nowadays, the MESC-classification still serves for the ordering of the documentation items in ZDM, another aim, however, is to facilitate searching for a particular item in MATHDI.

MSC

A. General
B. Educational policy, system and research
C. Psychology of Mathematics Education
D. Instruction, Goals, Teaching Methods, Assessment, Curriculum Development
E. Logic, Language, Proofs
F. Arithmetic, Numbers, Measures, Ratio
G.-K. Mathematical fields
M. Mathematical Modelling ,Applications
U.Educational Media, CAI, Technology

4.1.2 Languages

English dominates the publishing output in mathematics, but this is not as much the case in mathematics education. Journals published in English-speaking countries restrict themselves with few exceptions to articles written in English. Some scientific journals in mathematics didactics published in other countries prefer to publish mainly articles in English. But mostly, the language of choice for journals in mathematics education is the native language. So, articles of some 30 languages are indexed and reviewed in ZDM/MATHDI.

The bibliographic details for each entry, especially the title, are in the original language. For each title other than English there is an English translation. English is the primary language in the information services ZDM/MATHDI, but abstracts in French, German and Spanish are also included.

4.2 Articles Section of ZDM

The articles section of ZDM is an international journal with contributions in English, French or German. It provides survey articles and state-of-the-art reports on educational problems, discussions of current issues and problems in mathematics and computer science education, literature reports as well as reports on international conferences. Furthermore in the book reviews, selected publications are discussed in detail by experts in this field

One emphasis in the articles section of ZDM is on surveys. Expository writing brings together research results, often treating both theory and applications. It also pays special attention to the consolidation of related results, simplification, and the development of relationships in a general body of theory. It also involves presenting mathematics education research to non-specialists ("Non-specialist" meaning a mathematics educator who is not a worker in the specific area of research being treated). Therefore the articles section of ZDM is useful for many mathematics educators to get overviews on many research areas in maths education.

The articles section of ZDM is published electronically on the Internet via WWW. The full text of the ZDM articles section is online available (as PDF files) free of charge to individuals or institutions which subscribe to the print version of the current ZDM volume.

All other mathematics educators and interested persons can now also retrieve previous articles, free of charge, after the first year of publication. The articles of issues of volume 22 (1990) to volume 31 (1999) can be accessed by everyone via the Internet through the EMS server under www.fiz-karlsruhe.de/fiz/publications/zdm/zdmp1.html. Our chief aim is to extend scholarly communication, and we think the electronic medium offers new possibilities for this purpose.

Enjoy surfing through the articles of ZDM articles section on EMIS and thus get an impression of the developments in mathematics education during the past decade.

5. Literature on Some Conference Themes

The abstracting service ZDM/MATHDI, possibly complemented by other ones, enables specialists in mathematics education to keep up with the literature in their subject by providing them with a manageable source of information on current developments, controversies and advances, selected from virtually the whole of the international literature. In addition ZDM/MATHDI assist in maximizing the use of the time scholars have available for reading. They spend their available reading time scanning core journals and can then use abstracting services covering their field to identify other papers.

In addition online databases can be scanned to highlight trends in research. Mathematics and mathematics education, like other subjects, suffer fashions and a given topic may be an active research area for a time and may then be neglected temporarily. Such a topic is now "The Impact of Computer or Calculator Technology on Mathematics Education". By identifying the annual total of articles published in the past five years one can see an increasing interest in this general subject.

Emerging technologies are changing different aspects of society and science in different ways and their impact in mathematics is ever growing. On the one hand, progress in hardware speed permits the visualisation, simulation and animation of complex systems, and on the other, mathematical software is now able to reason algebraically and symbolically by means of computer algebra systems. In addition educational software in form of geometry software has been developed. This causes a plethora of publications stored in MATHDI dealing with discussions about technol-

ogy in the twenty-first century classroom, or investigations of the effectiveness of technology-based instruction.

Other trend-topics in research, discovered through searches in MATHDI, are mathematical applications at all levels, teacher education, and innovative curricula.

Here are a few examples of sample searches and the number of documents retrieved in MATHDI:

Title	Number of documents
Use of calculators in grades 10-13	423
Use of CAS in mathematics education	1,320
Teaching with Technology	3,835
Cooperative learning/teaching	444
Computer-assisted instruction in geometry	332
The International TIMS-Study (TIMSS)	186
Writing in mathematics	833
Trends in teacher education	107
Mathematics and other disciplines	2,852
Distance education	259
Curricula Innovations	275

In the following there are some samples of MATHDI records.

ANSWER 1 OF MATHDI COPYRIGHT 2002 FIZ KARLSRUHE
TI Teacher education and investigations into teacher education: a conference as a learning environment.
AU Krainer, Konrad (University of Klagenfurt (Austria))
SO European research in mathematics education I.III. Vol. 3. On research in Editor(s): Krainer, Konrad; Goffree, Fred; Berger, Peter
Forschungsinstitut fuer Mathematikdidaktik e.V., Osnabrueck (Germany) 1999. p. 13-39 of 250 p. Available from Forschungsinst. fuer Mathematikdidaktik, Osnabrueck.
Conference: 1. Conference of the European Society for Research in Mathematics Education (CERME-1), Osnabrueck (Germany), 27-31 Aug 1998
ISBN: 3-925386-55-6
DT Miscellaneous; Conference
CY Germany, Federal Republic of
LA English
IP FIZKA
DN ZD3331967

TI Writing about life: Creating original math projects with adults.
AU McCormick, Karen Hicks; Wadlington, Elizabeth (Southern Louisiana State University, LA (United States))
SO Adult numeracy development. Theory, research, practice.
Editor(s): Gal, Iddo
Creskill, NJ: Hampton Press. 2000. p. 197-221 of 377 p.

Ser. Title: Series on Literacy: Research, Policy, and Practice.
ISBN: 1-57273-233-4
DT Book Article
CY United States
LA English
AB This chapter presents a model for integrating learning of writing, reading, speaking, and listening with learning of mathematical concepts in ways that are meaningful for adult students. Three questions guide this chapter: How can adult educators integrate mathematics and language arts skills so that students perceive learning as a whole rather than in distinct, isolated parts? How can adult educators make mathematics relevant to students' daily lives so they become confident, competent problem solvers? How can adult educators provide activities that teach language processes and mechanics in such a way that learning is transferred to other areas, including mathematics and real life?
CC *M18 MATHEMATICAL MODELLING. INTERDISCIPLINARITY (FURTHER EDUCATION)
ST INTERDISCIPLINARY APPROACH; ADULT EDUCATION; FURTHER EDUCATION; LEARNING; AFFECTIVE VARIABLES; WORD PROBLEMS

ANSWER 3 OF 135 MATHDI COPYRIGHT 2002 FIZ KARLSRUHE
TI Reflections on the changing pedagogical use of computer algebra systems: assistance for doing or learning mathematics?.
AU Pierce, Robyn (University of Ballarat, VIC (Australia)); Stacey, Kaye (University of Melbourne, Parkville, VIC (Australia))
SO Journal of Computers in Mathematics and Science Teaching. (2001) v. 20(2) p. 143-161. CODEN: JCMTDV ISSN: 0731-9258
DT Journal
CY United States
LA English
AB This article documents a change in the use of a Computer Algebra System, (CAS), with a group of first year, undergraduate, mathematics students. CAS was initially used as an assistant for doing mathematics, enabling students to solve difficult problems. During the period of the study it came to be used as an assistant for learning mathematics, as a partner in the teaching and learning process. This article notes the changes required in organisation, teaching materials, and assessment, then reflects on changes in students' attitudes and learning outcomes. Surveys, interviews and teacher observations suggested that students' attitudes toward the use of CAS for learning mathematics were positive and that they believed that it aided their understanding. Students appreciated the availability of CAS for examinations. There was no demonstrable change in student achievement resulting from the changed pedagogical use of CAS. However changes in learning goals and assessment procedures mean that no simple comparison is possible.
CC D35 OBJECTIVES OF MATHEMATICS TEACHING (UNIVERSITIES, COLLEGES, POLYTECHNICS)
ST COMPUTER ALGEBRA; TEACHING METHODS; TEACHING-LEARNING PROCESSES; MATHEMATICS AND COMPUTERS

And here an example from the CD-ROM MATHDI

ZD3264099; MI1460482

Mathematics and new technologies. Matematica e novas tecnologias.

Ponte, J.P.; Canavarro, P.

Lisboa: Universidade Aberta. Aug 1997. 344 p.

ISBN: 972-674-207-2

Book

Portugal

Portuguese

This book is a resource for teacher education in new information technologies. It discusses the role of information and communication technologies (ICT) in society, in the activity of professional occupations and in education. It also analyses the relationships between ICT and mathematics, specially concerning scientific research and technological applications. It pays attention to the use of ICT in mathematics teaching, with reference to a number of curriculum topics and providing classroom examples. It also presents software and equipment useful for mathematics education.

6. Concluding Remarks

Scientific work depends mainly on information and exchange of ideas. In this time of abundant information there is a need to get a quick overview over relevant published articles or books in mathematics education, either in order to locate studies or to get inspired by a classroom experiment, or to be better informed about the accomplishments of scientists working in the same field. To access information in the field of mathematics education you should simply use ZDM/MATHDI with its 95.000 citations.

Attn: Dayga Sonnet

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